

Patent Claims

1. Multilayer ceramic component with a stack of alternating ceramic layers (KS) and electrode layers that serve as internal electrodes, wherein the internal electrodes (IE₁, IE₂) are connected to external contacts (AK₁, AK₂), which are arranged on opposite external sides of the stack, perpendicular to the multilayer structure, wherein the internal electrodes that are connected to different external contacts are in interlocking engagement with one another, wherein the electrode layers contain copper,

characterized in that

10 the external contacts (AK₁, AK₂) contain metallic copper,
wherein in the boundary area that lies adjacent to the boundary surface between the external contacts and the ceramic layers the external contacts are not oxidized and the material of the ceramic layers is not reduced,
wherein the bonding strength of the external contacts on the stack exceeds 50 N.

15 2. Component according to claim 1, in which the external contacts (AK₁, AK₂) contain a proportion of ceramic.

20 3. Component according to claim 1 or 2, in which the internal electrodes contain a proportion of ceramic.

4. Component according to claim 2 or 3, in which the ceramic proportion is ≤ 50 m%.

5. Component according to claim 4, in which the ceramic proportion lies between 5 and 50 m%.

6. Component according to one of claims 2 through 5, in which the ceramic proportion contains ceramic particles having an average grain size of between 0.2 and 0.6 μm .

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7. Component according to one of claims 1 through 6, which is produced from ceramic green films that contain a thermohydrolytically degradable binding agent.

15 8. Component according to one of claims 1 through 7, in which the ceramic layers comprise a ferroelectric perovskite ceramic of the general composition ABO_3 .

9. Component according to claim 8, in which the perovskite ceramic is of the PZT type $\text{Pb}(\text{Zr}_{1-x}\text{Ti}_x)\text{O}_3$ wherein $1 \geq x \geq 0$.

20 10. Component according to one of claims 1 through 9, in which the thickness of the external contacts lies between 10 and 20 μm .

11. Method for producing a component according to one of claims 1 through 10,
in which the debinding is conducted at a temperature of $\leq 300^\circ\text{C}$ in a nitrogen stream
with the addition of water vapor, and in this manner the debinding process is completed,

5 wherein, at least during the debinding process, the oxygen partial pressure does
not drop below a level of p_{\min} , at which the ceramic will begin to reductively degrade,
wherein the oxygen partial pressure does not exceed a level of p_{\max} , at which the
metallic copper will begin to oxidize at the given temperature.

10 12. Method according to claim 11,

 wherein p_{\min} corresponds to the equilibrium point for $\text{Cu}/\text{Cu}_2\text{O}$,

 wherein p_{\max} corresponds to the equilibrium point for Pb/PbO or Pb/PbTiO_3 .

15 13. Method according to claim 11 or 12, in which to produce external contacts a
copper-containing metal paste comprising a copper content of $> 70\text{ m}\%$, a glass frit and an
organic binder is used.

20 14. Method according to claim 13, in which an acrylic resin binder is used as the
organic binder.

15. Method according to claim 13 or 14, in which the glass flow contains
essentially PbO and SiO_2 .

16. Method according to one of claims 13 through 15, in which the copper-containing metal paste is fired on at between 700 and 860° C.

5 17. Method according to claim 16, in which the debinding and the firing on of the copper-containing metal paste are performed on a copper base layer.

18. Method according to one of claims 13 through 17, in which the copper-containing metal paste is applied by means of a screen printing process.

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19. Method for producing a multilayer ceramic component with alternating ceramic layers and internal electrode layers,

in which a ceramic mass is used to create the ceramic layers,

in which a metal paste that contains a portion of a chemically active additive is

15 used to create the internal electrode layers,

wherein the chemically active additive reacts chemically with at least one component in its environment other than the metal portion of the metal paste.

20 20. Method according to claim 19, in which a chemically active ceramic powder is used as the chemically active additive.

21. Method according to claim 19 or 20, in which the components of the environment are selected from oxygen, at least one component of the ceramic mass and a binder or solvent that is contained in the metal paste or the ceramic mass.

§ 22. Method according to one of claims 19 through 21, in which lead-containing ceramic mass is used,

wherein as a result of a chemical reaction between the chemically active additive and its environment, oxygen is released and/or Pb and/or Cu are bonded.

10 23. Method according to one of claims 19 through 22, in which at least one additive is used as the chemically active additive, selected from the group of $(Zr, Ti)O_2$, MgO and BaO_2 .

15 24. Method according to one of claims 19 through 23, in which a non-precious metal is used as the metal portion of the metal paste.

25. Method according to claim 24, in which Cu or Ni is used as the metal portion of the metal paste.